STIC Search Report
EIC 1700

STIC Database Tracking Number: 204573

TO: Tony S Chuo
Location: REM 6C11
Art Unit : 1745
October 23, 2006

Case Serial Number: 10/668976

From: Ross Shipe
Location: EIC 1700
REMSEN 4B31
Phone: 571/272-6018
Ross.Shipe@uspto.gov

Search Notes

Examiner Chuo:

Please review the attached search results.

The first reference set has both cathode and anode being nanotubes and starts on page 2.

The second answer set has an anode or cathode with mwnt or swnt and starts on page 20.

I did a broader search of nanotube# (2a) anode and nanotube# (2a) cathode with lithium battery.

I got 4 hits that start on page 35.

If you have any questions or if you would like to refine the search query, please feel free to contact me at any time.

Thanks you for using EIC 1700 search services!

Ross Shipe (ASRC)
Technical Information Specialist

Access DB# 214573

SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: Chu Examiner # :_____ Date: 10/23/06
Art Unit: _____ Phone Number 30_____ Serial Number: 10/669,956
Mail Box and Bldg/Room Location: _____ Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

****

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: Carbon Nanotube Lithium Battery

Inventors (please provide full names): _____

Earliest Priority Filing Date: _____

**For Sequence Searches Only* Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.*

****

STAFF USE ONLY	Type of Search		Vendors and cost where applicable	
Searcher: ROS	NA Sequence (#)		STN	✓
Searcher Phone #:	AA Sequence (#)		Dialog	
Searcher Location:	Structure (#)		Questel/Orbit	
Date Searcher Picked Up:	Bibliographic	✓	Dr.Link	
Date Completed: 10/23/06	Litigation		Lexis/Nexis	
Searcher Prep & Review Time: 30	Fulltext		Sequence Systems	
Clerical Prep Time:	Patent Family		WWW/Internet	
Online Time: 34	Other		Other (specify)	

PTO-1590 (8-01)

Banks, Kendra 204573

From: TONY CHUO [Tony.Chuo@uspto.gov]
Sent: Monday, October 16, 2006 1:42 PM
To: STIC-EIC1700
Subject: Database Search Request, Serial Number: 10668976

Requester:
TONY CHUO (P/1745)
Art Unit:
GROUP ART UNIT 1745
Employee Number:
81950
Office Location:
REM 06C11
Phone Number:
(571)272-0717
Mailbox Number:

Case serial number:
10668976
Class / Subclass(es):
429/122
Earliest Priority Filing Date:
5/20/03
Format preferred for results:
Paper
Search Topic Information:
A battery comprising an anode and a cathode that are both carbon nanotubes wherein the carbon nanotube is selected from the group consisting of multi-walled nanotube and single-walled nanotube.
Special Instructions and Other Comments:

STIC Search Results Feedback Form

EIC17000

Questions about the scope or the results of the search? Contact ***the EIC searcher or contact:***

Kathleen Fuller, EIC 1700 Team Leader
571/272-2505 REMSEN 4B28

Voluntary Results Feedback Form

- *I am an examiner in Workgroup:* ☐ *Example: 1713*
- *Relevant prior art **found**, search results used as follows:*
  - ☐ 102 rejection
  - ☐ 103 rejection
  - ☐ Cited as being of interest.
  - ☐ Helped examiner better understand the invention.
  - ☐ Helped examiner better understand the state of the art in their technology.

Types of relevant prior art found:

- ☐ Foreign Patent(s)
- ☐ Non-Patent Literature
  (journal articles, conference proceedings, new product announcements etc.)

- *Relevant prior art **not found:***
  - ☐ Results verified the lack of relevant prior art (helped determine patentability).
  - ☐ Results were not useful in determining patentability or understanding the invention.

Comments:

Drop off or send completed forms to EIC1700 REMSEN 4B28

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=> d his full

     (FILE 'HOME' ENTERED AT 11:45:22 ON 23 OCT 2006)

     FILE 'REGISTRY' ENTERED AT 11:52:21 ON 23 OCT 2006
L1             1 SEA ABB=ON  PLU=ON  CARBON/CN
L2             1 SEA ABB=ON  PLU=ON  GRAPHITE/CN
L3             1 SEA ABB=ON  PLU=ON  LITHIUM/CN

     FILE 'HCAPLUS' ENTERED AT 11:53:19 ON 23 OCT 2006
L4       4455789 SEA ABB=ON  PLU=ON  L1 OR L2 OR CARBON OR GRAPHITE OR C
L5        397713 SEA ABB=ON  PLU=ON  L3 OR LITHIUM OR LI
L6         35853 SEA ABB=ON  PLU=ON  CNT OR CARBON NANOTUBE# OR NANOTUBE#
L7          9345 SEA ABB=ON  PLU=ON  MWNT# OR SWNT# OR MULTI? WALL? (2A)
                 NANOTUBE# OR MULTIWALL? (2A) NANOTUBE# OR SINGLE? (2A)
                 WALL? NANOTUBE# OR SINGLEWALL? (2A) NANOTUBE#
L8           486 SEA ABB=ON  PLU=ON  L4 (L) L6 (L) BATTER?
L9           295 SEA ABB=ON  PLU=ON  L4 (L) L6 (L) BATTER? (L) L5
L10           62 SEA ABB=ON  PLU=ON  L4 (L) L6 (L) BATTER? (L) L5 (L)
                 CATHODE#
L11          146 SEA ABB=ON  PLU=ON  L4 (L) L6 (L) BATTER? (L) L5 (L)
                 ANODE#
L12           27 SEA ABB=ON  PLU=ON  L10 AND L11
L13           14 SEA ABB=ON  PLU=ON  L10 AND L7
L14           37 SEA ABB=ON  PLU=ON  L11 AND L7
L15           27 SEA ABB=ON  PLU=ON  L12 AND ELECTROCHEM?/SC,SX
L16           19 SEA ABB=ON  PLU=ON  L15 AND (1840-2003)/PRY,PY,AY
L17           43 SEA ABB=ON  PLU=ON  L13 OR L14
L18           41 SEA ABB=ON  PLU=ON  L17 AND ELECTROCHEM?/SC,SX
L19           21 SEA ABB=ON  PLU=ON  L18 AND (1840-2003)/PRY,PY,AY
L20            1 SEA ABB=ON  PLU=ON  2004:1019587/AN
L21           20 SEA ABB=ON  PLU=ON  L20 OR L16
L22           15 SEA ABB=ON  PLU=ON  L19 NOT L21


=> file reg
FILE 'REGISTRY' ENTERED AT 12:17:35 ON 23 OCT 2006
USE IS SUBJECT TO THE TERMS OF YOUR STN CUSTOMER AGREEMENT.
PLEASE SEE "HELP USAGETERMS" FOR DETAILS.
COPYRIGHT (C) 2006 American Chemical Society (ACS)


=> d l21 que stat
L1             1 SEA FILE=REGISTRY ABB=ON  PLU=ON  CARBON/CN
L2             1 SEA FILE=REGISTRY ABB=ON  PLU=ON  GRAPHITE/CN
L3             1 SEA FILE=REGISTRY ABB=ON  PLU=ON  LITHIUM/CN
L4       4455789 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L1 OR L2 OR CARBON OR
                 GRAPHITE OR C
L5        397713 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L3 OR LITHIUM OR LI
L6         35853 SEA FILE=HCAPLUS ABB=ON  PLU=ON  CNT OR CARBON NANOTUBE#
                 OR NANOTUBE#
L10           62 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L4 (L) L6 (L) BATTER?
                 (L) L5 (L) CATHODE#
L11          146 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L4 (L) L6 (L) BATTER?
                 (L) L5 (L) ANODE#
L12           27 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L10 AND L11
L15           27 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L12 AND ELECTROCHEM?/SC,
                 SX
L16           19 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L15 AND (1840-2003)/PRY,
                 PY,AY
L20            1 SEA FILE=HCAPLUS ABB=ON  PLU=ON  2004:1019587/AN
L21           20 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L20 OR L16


=> file hcaplus
FILE 'HCAPLUS' ENTERED AT 12:17:44 ON 23 OCT 2006
```

=> d l21 1-20 ibib abs hitstr hitind

L21 ANSWER 1 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2006:1079963 HCAPLUS
TITLE: Rechargeable lithium battery
INVENTOR(S): Huang, Chuan-De
PATENT ASSIGNEE(S): Hon Hai Precision Industry Co., Ltd., Taiwan
SOURCE: Taiwan., 4pp.
CODEN: TWXXA5
DOCUMENT TYPE: Patent
LANGUAGE: Chinese
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
TW 238555	B1	20050821	TW 2003-92118395	20030704

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PRIORITY APPLN. INFO.: TW 2003-92118395 20030704

<--

AB The present invention relates to a rechargeable **lithium battery** which includes an **anode**, a **cathode** and a porous separator disposed between the **anode** and the **cathode.** The **cathode** has a transitional metal oxide or sulfide as active material. The **anode** includes a conductive substrate, a layer of **carbon nanotubes** formed on the conductive substrate and a layer of **lithium** metal formed on the layer of **carbon nanotubes.** The **battery** of the present invention employs **lithium** metal as active material, thus it may improve the energy d. Furthermore, the sepn. of the **lithium** metal and the substrate avoids reaction between them and lengthens the lifetime of the **battery.**

IC ICM H01M010-36
ICS H01M004-00
CC 52 (**Electrochemical**, Radiational, and Thermal Energy Technology)

L21 ANSWER 2 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2006:782355 HCAPLUS
DOCUMENT NUMBER: 145:252335
TITLE: Manufacture of electrode and lithium secondary battery using the electrode comprising multi-walled carbon nanotube
INVENTOR(S): Choi, Sang Jin; Do, Chil Hun; Kang, Geun Yeong; Mun, Seong In; Yoon, Mun Su
PATENT ASSIGNEE(S): Korea Electro Technology Research Institute, S. Korea
SOURCE: Repub. Korean Kongkae Taeho Kongbo, No pp. given
CODEN: KRXXA7
DOCUMENT TYPE: Patent
LANGUAGE: Korean
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE

KR 2004084114	A	20041006	KR 2003-18942	200303 26

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PRIORITY APPLN. INFO.: KR 2003-18942 200303 26

<--

AB Provided is a **lithium** secondary **battery** using an electrode comprising a multi-walled **carbon nanotube** which has high specific capacity and improved energy characteristic by the reversible adsorption and desorption of **lithium** ion. A method for manufg. the electrode is also provided. The electrode is manufd. by mixing a multi-walled **carbon nanotube** material with a binder and a dispersion medium to obtain an electrode mixt.; applying the electrode mixt. onto a collector, and drying. The **battery** has an **anode** composed of the above electrode; a **cathode** comprising a transition metal compd. material; a multiporous separator which is **lithium** ion-conductible and electron-nonconductible; and a **lithium** salt conduction medium.

IC ICM H01M004-04

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)

ST manuf **anode lithium** secondary **battery** **carbon nanotube**

IT **Nanotubes**
(**carbon**; manuf. of **anodes** contg. multi-walled **carbon nanotube** materials for secondary **lithium batteries**)

IT Secondary **batteries**
(**lithium**; manuf. of **anodes** contg. multi-walled **carbon nanotube** materials for secondary **lithium batteries**)

IT **Battery anodes**
(manuf. of **anodes** contg. multi-walled **carbon nanotube** materials for secondary **lithium batteries**)

L21 ANSWER 3 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2005:1116683 HCAPLUS

DOCUMENT NUMBER: 143:463074

TITLE: Carbon nanotube lithium secondary battery

INVENTOR(S): Huang, Quande

PATENT ASSIGNEE(S): Hongfujin Precision Industry Shenzhen Co., Ltd., Peop. Rep. China; Hon Hai Precision Industry Co., Ltd.

SOURCE: Faming Zhuanli Shenqing Gongkai Shuomingshu, 6 pp.
CODEN: CNXXEV

DOCUMENT TYPE: Patent

LANGUAGE: Chinese

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
CN 1567615	A	20050119	CN 2003-139734	200307 02

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PRIORITY APPLN. INFO.: CN 2003-139734

200307
02
<--

AB This invention relates to a **carbon nanotube** **lithium** secondary **battery**, which comprises a **cathode** contg. active materials of transition-metal oxide or sulfide, an **anode**, and a porous barrier membrane disposed between the **anode** and the **cathode**, wherein the **anode** includes a conductive substrate, a **carbon** **nanotube** layer formed on the surface of the substrate, and a **lithium** layer formed on the surface of the **carbon** **nanotube** layer. This invention fully utilizes the advantage of high energy d. of **lithium**, and prevents the reaction caused by the direct contact between **lithium** and the substrate, resulting in prolonged service life of the **battery** and increased elec. capacity.

IT **7440-44-0, Carbon**, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(**nanotubes; carbon nanotube** **lithium** secondary **battery anode**)

RN 7440-44-0 HCAPLUS

CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

IC ICM H01M004-02
ICS H01M004-36; H01M002-16; H01M010-36

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)

ST **carbon nanotube anode lithium** secondary **battery**

IT **Nanotubes**
(**carbon; carbon nanotube** **lithium** secondary **battery anode**)

IT **Battery anodes**
(**lithium battery; carbon** **nanotube** as conductors for)

IT **7440-44-0, Carbon**, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(**nanotubes; carbon nanotube** **lithium** secondary **battery anode**)

L21 ANSWER 4 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2005:467699 HCAPLUS
DOCUMENT NUMBER: 143:29421
TITLE: Lithium-ion battery
INVENTOR(S): Chen, Jieliang; Lu, Changyue
PATENT ASSIGNEE(S): Hongfujin Precision Industry Shenzhen Co. Ltd., Peop. Rep. China
SOURCE: Faming Zhuanli Shenqing Gongkai Shuomingshu, No pp. given
CODEN: CNXXEV
DOCUMENT TYPE: Patent
LANGUAGE: Chinese
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
CN 1516304	A	20040728	CN 2003-113512	200301 03

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PRIORITY APPLN. INFO.: CN 2003-113512
200301
03

<--

AB This **battery** has a **cathode**, an **anode** and a permeation isolation film. The **cathode** contains nano-sized LixCoyNizO2 particles, the **anode** consists of **C nanotubes**, each multi-walled **C nanotube** contains many coaxial **graphite** tube layers, and **Li** ions can be embedded between adjacent **graphite** tube layers. The nano LixCoyNizO2 particles have a large sp. surface area and high chem. activity which increase **battery** capacity.

IT **7440-44-0, Carbon**, uses
RL: DEV (Device component use); USES (Uses)
(**nanotubes, anode** contg.; **anode** and **cathode** material for **lithium**-ion **batteries**)

RN 7440-44-0 HCAPLUS
CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

IC ICM H01M004-58
ICS H01M004-48; H01M010-36

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)

IT **Nanotubes**
(**carbon, anode** contg.; **anode** and **cathode** material for **lithium**-ion **batteries**)

IT **7440-44-0, Carbon**, uses
RL: DEV (Device component use); USES (Uses)
(**nanotubes, anode** contg.; **anode** and **cathode** material for **lithium**-ion **batteries**)

L21 ANSWER 5 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: **2004:1019587** HCAPLUS
DOCUMENT NUMBER: 141:426330
TITLE: Novel carbon nanotube lithium battery
INVENTOR(S): Morris, Robert Scott; Dixon, Brian Gilbert
PATENT ASSIGNEE(S): Phoenix Innovation, Inc., USA
SOURCE: U.S. Pat. Appl. Publ., 13 pp.
CODEN: USXXCO
DOCUMENT TYPE: Patent
LANGUAGE: English
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
US 2004234844	A1	20041125	US 2003-668976	200309 23
WO 2005022666	A2	20050310	WO 2004-US15767	200405 20

W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD,

SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW
RW: BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG

EP 1656709	A2	20060517	EP 2004-776053	200405 20

R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR, BG, CZ, EE, HU, PL, SK, HR

PRIORITY APPLN. INFO.:	US 2003-471780P	P	200305 20
	US 2003-668976	A	200309 23
	WO 2004-US15767	W	200405 20

AB This simplified self-powered attitude indicator gives a visual indication of aircraft attitude and has suitable indicators and operational alarms. The indicator is self-powered and readily transferable between aircraft. This indicator does not replace the std. gyroscopic indicator, but supplements it.

IC ICM H01M006-00
INCL 429122000
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

L21 ANSWER 6 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2004:987579 HCAPLUS
DOCUMENT NUMBER: 142:201502
TITLE: Manufacture of anode for secondary lithium battery and the battery
INVENTOR(S): Choi, Sang Jin; Do, Chil Hun; Mun, Seong In
PATENT ASSIGNEE(S): Korea Electro Technology Research Institute, S. Korea
SOURCE: Repub. Korean Kongkae Taeho Kongbo, No pp. given
CODEN: KRXXA7
DOCUMENT TYPE: Patent
LANGUAGE: Korean
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
KR 2003092902	A	20031206	KR 2002-30748	200205 31

<--

PRIORITY APPLN. INFO.: KR 2002-30748 200205 31

<--

AB The **anode** is prepd. by mixing multi-wall **C nanotubes** with a binder and a dispersing medium, applying the mixt. on a collector, and drying. The coated collector may be compressed. A secondary **lithium battery** use the **anode** and a transition metal compd. **cathode.**

IT **7440-44-0, Carbon**, uses

RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)
(manuf. of multi-wall **carbon nanotube anodes** for secondary **lithium batteries**)
RN 7440-44-0 HCAPLUS
CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

IC ICM H01M004-02
CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
ST secondary **lithium battery** multiwall **carbon nanotube anode** manuf
IT **Nanotubes**
(**carbon**; manuf. of multi-wall **carbon nanotube anodes** for secondary **lithium batteries**)
IT **Battery anodes**
(manuf. of multi-wall **carbon nanotube anodes** for secondary **lithium batteries**)
IT **7440-44-0, Carbon**, uses
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)
(manuf. of multi-wall **carbon nanotube anodes** for secondary **lithium batteries**)

L21 ANSWER 7 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2004:970631 HCAPLUS
DOCUMENT NUMBER: 142:180388
TITLE: Lithium secondary batteries with carbon nanotubes as conducting material
INVENTOR(S): Han, Yeong Su; Shin, Jin Guk
PATENT ASSIGNEE(S): Lg Electronics Inc., S. Korea
SOURCE: Repub. Korean Kongkae Taeho Kongbo, No pp. given
CODEN: KRXXA7
DOCUMENT TYPE: Patent
LANGUAGE: Korean
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
KR 2003013553	A	20030215	KR 2001-47618	20010808
			<--	
PRIORITY APPLN. INFO.:			KR 2001-47618	20010808
			<--	

AB This secondary **battery** has an improved discharge capacity and an enhanced rate capability by using **C nanotubes** as conducting material. The **battery** comprises a **cathode**, an electrolyte and an **anode**, wherein **C nanotubes** are used as a conducting material providing a pathway for reactants and electrons. The **C nanotubes** can be replaced by **C**

nanowires or C nanoparticles. Optionally a mixt. of **C nanotubes** and C black is used as a conducting material. Preferably the secondary **battery** is a **Li-S battery**, a **Li-FeS battery**, a **Li-Ti2S battery** and a **Li**-organosulfur **battery**, or a **Li**-based secondary **battery** comprising a **Li**-ion **battery**, a **Li** polymer **battery** and a **Li-MnO2 battery**.

IC ICM H01M010-02
CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)

L21 ANSWER 8 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2004:857824 HCAPLUS
DOCUMENT NUMBER: 141:352740
TITLE: Surfactant-treated lithium battery electrodes for improved solid electrolyte interface during cycling
INVENTOR(S): Morris, Robert Scott; Dixon, Brian Gilbert
PATENT ASSIGNEE(S): Phoenix Innovations, Inc., USA
SOURCE: PCT Int. Appl., 21 pp.
CODEN: PIXXD2
DOCUMENT TYPE: Patent
LANGUAGE: English
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2004088769	A2	20041014	WO 2004-US3750	200402 09
WO 2004088769	A3	20050203		

W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW

RW: BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG

EP 1597783	A2	20051123	EP 2004-709487	200402 09

R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR, BG, CZ, EE, HU, SK

JP 2006520082	T2	20060831	JP 2006-508704	200402 09

PRIORITY APPLN. INFO.:	US 2003-447500P	P	200302 19
	WO 2004-US3750	W	200402 09

AB Novel **lithium batteries** with improved interfacial contact and decreased impedance between the electrolyte and the electrodes, resulting in improved safety (esp. to prevent overcharging during cycling) are characterized by having one or both surfactant-modified electrodes, a porous separator, and an electrolyte. The **anode** is esp. a **carbon anode** (e.g., **graphite**, mesocarbon microbeads, buckyballs, and multiwall and single-walled **carbon nanotubes**) that is coated with a fluorinated, nonionic, or cationic surfactant; the **cathode** is esp. a **lithium** metal oxide (e.g., LiNiCoO2, LiCoO2, LiNO2, and LiMnO2) coated with a fluorinated, dimeric, cationic, or nonionic surfactant. All the surfactants have an incorporated reactive end group of various reactive functionality (e.g., vinyl, allyl, acrylate, propargyl, diene, polyene, etc). The electrolytes include nonaq. org. electrolytes and can incorporate added **lithium** salts.

IC ICM H01M

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 46

L21 ANSWER 9 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2004:550617 HCAPLUS
DOCUMENT NUMBER: 141:91858
TITLE: Lithium ion battery comprising nanomaterials
INVENTOR(S): Chen, Ga-Lane; Leu, Charles
PATENT ASSIGNEE(S): Hon Hai Precision Ind. Co., Ltd., Taiwan
SOURCE: U.S. Pat. Appl. Publ., 5 pp.
CODEN: USXXCO
DOCUMENT TYPE: Patent
LANGUAGE: English
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
US 2004131937	A1	20040708	US 2003-404467	20030331 <--
US 7060390	B2	20060613		
TW 236778	B1	20050721	TW 2003-92100154	20030106 <--
JP 2004214162	A2	20040729	JP 2003-106946	20030410 <--
US 2006204853	A1	20060914	US 2005-293341	20051202 <--
PRIORITY APPLN. INFO.:			TW 2003-92100154 A	20030106 <--
			US 2003-404467 A1	20030331 <--

AB A **lithium** ion **battery** includes a **cathode** having a plurality of nanoparticles of **lithium** doped transition metal alloy oxides represented by the formula

LixCoyNizO2, an **anode** having at least one **carbon nanotube** array, an electrolyte, and a membrane sepg. the **anode** from the **cathode.** The **carbon nanotube** array includes a plurality of multi-walled **carbon nanotubes.** Preferably, an av. diam. of an outermost wall of the multi-walled **carbon nanotubes** is in the range from 10 to 100 nm, and a pitch between adjacent multi-walled **carbon nanotubes** is in the range from 20 to 500 nm. In the **carbon nanotube** array, the **lithium** ions are able to intercalate not only inside the multi-walled **carbon nanotubes**, but also in the interstices between adjacent multi-walled **carbon nanotubes.** Thus a d. of intercalation of the **carbon nanotube** array is significantly higher than that of **graphite.**

IC ICM H01M004-58
ICS H01M004-52
INCL 429231800; X42-922.3; X42-923.13
CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
REFERENCE COUNT: 7 THERE ARE 7 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L21 ANSWER 10 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2003:910341 HCAPLUS
DOCUMENT NUMBER: 139:397965
TITLE: Lithium secondary battery made with carbon nanotube for high output and high capacity without short circuit
INVENTOR(S): Kumashiro, Yoshiaki; Okumura, Takefumi; Kasai, Masahiro
PATENT ASSIGNEE(S): Hitachi Ltd., Japan
SOURCE: Jpn. Kokai Tokkyo Koho, 8 pp.
CODEN: JKXXAF
DOCUMENT TYPE: Patent
LANGUAGE: Japanese
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2003331838	A2	20031121	JP 2002-137899	200205 14
			<--	
PRIORITY APPLN. INFO.:			JP 2002-137899	200205 14
			<--	

AB The **Li** secondary **battery** has **cathode** made with **carbon nanotube** as elec. conductor, **anode** made from **carbon nanotube**, and a gel-form electrolyte contg. polymer, nonaq. electrolyte and alkali metal salt. The **cathode** material contains compd. oxides, and the **anode** material contains **graphite**, amorphous **C**, Si or Si oxide.

IT **7440-44-0, Carbon**, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(amorphous, **anode** contg.; **lithium** secondary **battery** made with **carbon nanotube** for high output and high capacity without short circuit)
RN 7440-44-0 HCAPLUS
CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

IT **7782-42-5, Graphite**, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(**anode** contg.; **lithium** secondary **battery** made with **carbon nanotube** for high output and high capacity without short circuit)
RN 7782-42-5 HCAPLUS
CN Graphite (8CI, 9CI) (CA INDEX NAME)

C

IC ICM H01M004-58
ICS H01M004-02; H01M004-38; H01M004-48; H01M004-62; H01M010-40
CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
IT **7440-44-0, Carbon**, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(amorphous, **anode** contg.; **lithium** secondary **battery** made with **carbon nanotube** for high output and high capacity without short circuit)
IT 7440-21-3, Silicon, uses 7631-86-9, Silica, uses **7782-42-5**, **Graphite**, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(**anode** contg.; **lithium** secondary **battery** made with **carbon nanotube** for high output and high capacity without short circuit)
IT 12031-65-1, **Lithium** nickel oxide (LiNiO2) 12190-79-3, Cobalt **lithium** oxide (LiCoO2)
RL: TEM (Technical or engineered material use); USES (Uses)
(**cathode** active material; **lithium** secondary **battery** made with **carbon nanotube** for high output and high capacity without short circuit)

L21 ANSWER 11 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2003:675727 HCAPLUS
DOCUMENT NUMBER: 139:182903
TITLE: Secondary lithium battery
INVENTOR(S): Tsushima, Manabu; Morimoto, Takeshi
PATENT ASSIGNEE(S): Asahi Glass Co., Ltd., Japan
SOURCE: Jpn. Kokai Tokkyo Koho, 4 pp.
CODEN: JKXXAF
DOCUMENT TYPE: Patent
LANGUAGE: Japanese
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2003242975	A2	20030829	JP 2002-38408	200202 15 <--
PRIORITY APPLN. INFO.:			JP 2002-38408	200202 15 <--

AB The **battery** has an activated **C** based **cathode**, a **Li** intercalating carbonaceous **anode**, and a **Li** salt contg. org. electrolyte soln.; where the carbonaceous material for the **anode** is

C nanotubes. Preferably, the **nanotubes** have diam. 0.7-20 nm.

IT **7440-44-0, Carbon,** uses
RL: DEV (Device component use); USES (Uses)
(**nanotubes; lithium** intercalating **carbon nanotube anodes** for secondary **lithium batteries**)

RN 7440-44-0 HCAPLUS

CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

IC ICM H01M004-58
ICS H01G009-058; H01M004-02; H01M010-40

CC 52-2 (**Electrochemical,** Radiational, and Thermal Energy Technology)

ST secondary **lithium battery anode carbon nanotube**

IT **Nanotubes**
(**carbon; lithium** intercalating **carbon nanotube anodes** for secondary **lithium batteries**)

IT **Battery anodes**
(**lithium** intercalating **carbon nanotube anodes** for secondary **lithium batteries**)

IT **7440-44-0, Carbon,** uses
RL: DEV (Device component use); USES (Uses)
(**nanotubes; lithium** intercalating **carbon nanotube anodes** for secondary **lithium batteries**)

L21 ANSWER 12 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2003:458493 HCAPLUS

DOCUMENT NUMBER: 139:216878

TITLE: Effect of Multiwalled Carbon Nanotubes on Electrochemical Properties of Lithium/Sulfur Rechargeable Batteries

AUTHOR(S): Han, Sang-Cheol; Song, Min-Sang; Lee, Ho; Kim, Hyun-Seok; Ahn, Hyo-Jun; Lee, Jai-Young

CORPORATE SOURCE: Department of Materials Science and Engineering, Korea Advanced Institute of Science and Technology, Daejon, 305-701, S. Korea

SOURCE: Journal of the Electrochemical Society (**2003**), 150(7), A889-A893
CODEN: JESOAN; ISSN: 0013-4651

PUBLISHER: Electrochemical Society

DOCUMENT TYPE: Journal

LANGUAGE: English

AB To bestow high electronic cond. and prevent dissoln. of sulfur into the electrolyte, multi-walled **carbon nanotubes** (MWNTs) were prepd. by thermal CVD as an inactive additive material for elemental sulfur pos. electrodes for **lithium**/sulfur rechargeable **batteries.** The initial discharge capacity of elemental sulfur pos. electrode with MWNT is 485 mAh/g sulfur at 2.0 V vs. **Li/Li+.** The cycle life and rate capability of sulfur **cathode** is increased with addn. of MWNT. The MWNT shows a vital role on polysulfide adsorption and is a good elec. conductor for a sulfur **cathode.**

IT **7439-93-2, Lithium,** uses
RL: DEV (Device component use); USES (Uses)
(foil, **anode;** effect of multi-walled **carbon nanotubes** on electrochem. properties of **lithium** /sulfur rechargeable **batteries**)

RN 7439-93-2 HCAPLUS
CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 49, 76
IT **Battery cathodes**
Cyclic voltammetry
Electric conductivity
Electric current-potential relationship
(effect of multi-walled **carbon nanotubes** on electrochem. properties of **lithium**/sulfur rechargeable **batteries**)
IT **7439-93-2, Lithium**, uses
RL: DEV (Device component use); USES (Uses)
(foil, **anode**; effect of multi-walled **carbon nanotubes** on electrochem. properties of **lithium**/sulfur rechargeable **batteries**)
IT 7429-90-5, Aluminum, uses
RL: DEV (Device component use); USES (Uses)
(foil, **cathode** substrate; effect of multi-walled **carbon nanotubes** on electrochem. properties of **lithium**/sulfur rechargeable **batteries**)
REFERENCE COUNT: 17 THERE ARE 17 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L21 ANSWER 13 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2003:437474 HCAPLUS
DOCUMENT NUMBER: 139:263178
TITLE: Development and testing of nanomaterials for rechargeable lithium batteries
AUTHOR(S): Odani, A.; Nimberger, A.; Markovsky, B.; Sominski, E.; Levi, E.; Kumar, V. G.; Motiei, M.; Gedanken, A.; Dan, P.; Aurbach, D.
CORPORATE SOURCE: Department of Chemistry, Bar-Ilan University, Ramat Gan, 52900, Israel
SOURCE: Journal of Power Sources (**2003**), 119-121, 517-521
CODEN: JPSODZ; ISSN: 0378-7753
PUBLISHER: Elsevier Science B.V.
DOCUMENT TYPE: Journal
LANGUAGE: English
AB The use of nanoparticles in composite electrodes for **Li batteries** has kinetic advantages due to the redn. of the diffusion length for **Li** insertion in the active mass, and also because of the redn. of the overall charge transfer resistance of the electrodes. The synthesis of various types of nanomaterials for rechargeable **Li batteries** and their testing as active mass in **anodes** and **cathodes** are reported. These include SnO, VOx, LixMnO2, and various types of **C nanotubes**. Sonochem. was applied for the synthesis of part of the nanophases. The tools for this study included XRD, TEM, DSC, and the electrochem. techniques CV, SSCV, chronopotentiometry and impedance spectroscopy.
IT **7440-44-0P, Carbon**, uses
RL: DEV (Device component use); PNU (Preparation, unclassified); PREP (Preparation); USES (Uses)
(**nanotubes**; **carbon** nanomaterials as **anodes** for rechargeable **lithium batteries**)
RN 7440-44-0 HCAPLUS

CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
Section cross-reference(s): **72**
IT **Nanotubes**
(**carbon**; **carbon** nanomaterials as **anodes** for rechargeable **lithium batteries**)
IT **7440-44-0P**, **Carbon**, uses
RL: DEV (Device component use); PNU (Preparation, unclassified); PREP (Preparation); USES (Uses)
(**nanotubes**; **carbon** nanomaterials as **anodes** for rechargeable **lithium batteries**)
REFERENCE COUNT: 16 THERE ARE 16 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L21 ANSWER 14 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2003:413936 HCAPLUS
DOCUMENT NUMBER: 138:371788
TITLE: Lithium-ion battery with electrodes including single wall carbon nanotubes
INVENTOR(S): Ochoa, Rosibel; Kerzhner-Haller, Inna; Maleki, Hossein
PATENT ASSIGNEE(S): USA
SOURCE: U.S. Pat. Appl. Publ., 6 pp.
CODEN: USXXCO
DOCUMENT TYPE: Patent
LANGUAGE: English
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
US 2003099883	A1	20030529	US 2001-974283	20011110
			<--	
PRIORITY APPLN. INFO.:			US 2001-974283	20011110
			<--	

AB A **lithium**-ion **battery** that includes a plurality of electrodes, such as an **anode** and **cathode**, and at least one of the plurality of electrodes is made of a conductive material having a single wall fullerene-**carbon nanotube** additive. The use of single wall **carbon nanotubes** as an additive in the electrode materials, even in very small amts., improves the capacity, thermal stability, and safety of the electrode materials.
IC ICM H01M004-62
ICS H01M004-52
INCL 429232000; 429231100; 429231300; 429223000
CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)

L21 ANSWER 15 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2003:169072 HCAPLUS
DOCUMENT NUMBER: 138:387954

TITLE: Application of nanotechnology to lithium secondary batteries
AUTHOR(S): Wu, Yu-ping; Elke, Rahm; Rudolf, Holze
CORPORATE SOURCE: Department of Electrochemistry, Institute of Chemistry, Chemnitz University of Technologies, Chemnitz, 09107, Germany
SOURCE: Dianchi (2002), 32(6), 350-353
CODEN: DNCHEP; ISSN: 1001-1579
PUBLISHER: Dianchi Zazhishe
DOCUMENT TYPE: Journal; General Review
LANGUAGE: Chinese

AB A review of nanotechnol. pertaining to sol-gel methods, template methods, discharge of C bar, and mech. milling, as applicable to Li secondary batteries. With these nanotechnologies, cathodes, anodes and other materials were prepd. for Li batteries. The cathode materials include Li Co oxides, Li Ni oxides, Li Mn oxides, V oxides and the anode materials include carbonaceous materials, C nanotubes, Sn oxides, and metallic anodes. Examples of other nanomaterials are polymer electrolytes and conductive agents. All of these nanomaterials performed better electrochem. than those prepd. by traditional methods. Theor. research on nanotechnologies as applied to Li secondary batteries, is needed. With the development of nanotechnol., micro Li batteries will be manufd. in the future.

CC 52-0 (Electrochemical, Radiational, and Thermal Energy Technology)

L21 ANSWER 16 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2002:881125 HCAPLUS
DOCUMENT NUMBER: 138:240533
TITLE: Block Copolymer-Templated Nanocomposite Electrodes for Rechargeable Lithium Batteries
AUTHOR(S): Mui, S. C.; Trapa, P. E.; Huang, B.; Soo, P. P.; Lozow, M. I.; Wang, T. C.; Cohen, R. E.; Mansour, A. N.; Mukerjee, S.; Mayes, A. M.; Sadoway, D. R.
CORPORATE SOURCE: Massachusetts Institute of Technology, Department of Materials Science and Engineering, Cambridge, MA, 02139-4307, USA
SOURCE: Journal of the Electrochemical Society (2002), 149(12), A1610-A1615
CODEN: JESOAN; ISSN: 0013-4651
PUBLISHER: Electrochemical Society
DOCUMENT TYPE: Journal
LANGUAGE: English

AB A self-organizing, nanocomposite electrode (SONE) system was developed as a model lithium alloy-based anode for rechargeable lithium batteries. In situ x-ray adsorption spectroscopy, galvanostatic testing, cyclic voltammetry, x-ray diffraction, and TEM were used to analyze the electrode, which was fabricated from a polyethylene oxide-based block copolymer, single-walled carbon nanotubes, and gold salt. Processing involved a single mixing step without need of a reducing agent. Thermodn. self-assembly of the block copolymer could provide a template for incorporation of both the gold salt and nanotubes. Electrochem. testing and subsequent anal. showed that owing to the small particle size and the surrounding block copolymer matrix, the SONE system could cycle over 600 cycles with rates varying between C/1.8 and 8.8 C with little evidence of decrepitation or coarsening.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 38

ST block copolymer template nanocomposite electrode rechargeable **lithium battery**; **carbon nanotube** methacrylate copolymer composite film **lithium** gold **cathode**

IT **Nanotubes**
(**carbon**, single-walled, acid-treated, solvent cast composite film with POEM-b-PMMA, and **lithium**-gold salt, **cathode**; block copolymer-templated nanocomposite electrodes for rechargeable **lithium batteries**)

IT **Battery anodes**
(composite with **carbon nanotubes** and gold salt, **cathode**; block copolymer-templated nanocomposite electrodes for rechargeable **lithium batteries**)

IT 127691-09-2P
RL: DEV (Device component use); PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(block copolymer, solvent cast composite film with **carbon nanotubes**, and **lithium**-gold salt, **cathode**; block copolymer-templated nanocomposite electrodes for rechargeable **lithium batteries**)

IT 502169-73-5
RL: DEV (Device component use); PRP (Properties); USES (Uses)
(solvent cast composite film with POEM-b-PMMA, and **carbon nanotubes**, **cathode**; block copolymer-templated nanocomposite electrodes for rechargeable **lithium batteries**)

REFERENCE COUNT: 66 THERE ARE 66 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L21 ANSWER 17 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2002:870729 HCAPLUS
DOCUMENT NUMBER: 138:194879
TITLE: A feasibility study of scaling-up the electrolytic production of carbon nanotubes in molten salts
AUTHOR(S): Dimitrov, Aleksandar T.; Chen, George Z.; Kinloch, Ian A.; Fray, Derek J.
CORPORATE SOURCE: Department of Material Science and Metallurgy, University of Cambridge, Cambridge, CB2 3QZ, UK
SOURCE: Electrochimica Acta (**2002**), 48(1), 91-102
CODEN: ELCAAV; ISSN: 0013-4686
PUBLISHER: Elsevier Science Ltd.
DOCUMENT TYPE: Journal
LANGUAGE: English

AB The feasibility of scaling-up the electrolytic prodn. of **carbon nanotubes** in molten salts has been investigated with the aid of electron microscopy (TEM and SEM). Using molten LiCl as the electrolyte and com. **graphite** as both **cathode** and **anode** materials, **carbon** nanomaterials, including **nanotubes**, were prepd. by const. voltage electrolysis. The cell was more than 20 times as large as that used in previous work. The **nanotube** concn. in the final product increased with cell voltage (including iR drop) from 1 vol. % at 4.0 V to 35 vol. % at 8.4 V. Under desired conditions, the charge and energy consumption for the **cathode** erosion was 0.28 Ah/g and 4.1 Wh/g, of which 60-70 wt. % were for producing nanomaterials (**nanotubes**: >30 vol. %). When adding 1 wt. % SnCl2 to the electrolyte, partial and fully filled **nanotubes** were obtained with the nanomaterials contg. up to 20 wt.% Sn. Preliminary results from applying the product as the

electrode in **lithium** ion **batteries** are reported.
CC 72-2 (**Electrochemistry**)
Section cross-reference(s): **52**
REFERENCE COUNT: 20 THERE ARE 20 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L21 ANSWER 18 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 1999:658669 HCAPLUS
DOCUMENT NUMBER: 131:274220
TITLE: Organic electrolyte batteries with lithium manganese oxide cathode active materials
INVENTOR(S): Fukunaga, Takao
PATENT ASSIGNEE(S): Japan Storage Battery Co., Ltd., Japan
SOURCE: Jpn. Kokai Tokkyo Koho, 6 pp.
CODEN: JKXXAF
DOCUMENT TYPE: Patent
LANGUAGE: Japanese
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 11283629	A2	19991015	JP 1998-100037	199803 27
			<--	
PRIORITY APPLN. INFO.:			JP 1998-100037	199803 27
			<--	

AB The **batteries** consist of a **cathode** comprising Mn-based **Li** mixed oxide active material, **C nanotube** elec. conductor, and a binder; an **anode**; and an org. electrolyte. The **batteries** are suitable for use in elec. automobiles, portable elec. app., e.g. laptop computer, liq. crystal TV, etc.
IC ICM H01M004-62
ICS H01M004-02; H01M010-40
CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
ST **lithium** manganese oxide org **battery cathode**; **carbon nanotube** conductor **battery cathode**
IT **Nanotubes**
RL: DEV (Device component use); USES (Uses)
(**carbon**, elec. conductor in **cathode**; org. electrolyte **batteries** with **cathodes** comprising **lithium** manganese oxide and **carbon nanotube**)
IT **Battery cathodes**
(org. electrolyte **batteries** with **cathodes** comprising **lithium** manganese oxide and **carbon nanotube**)
IT 12057-17-9, **Lithium** manganese oxide (LiMn2O4)
RL: DEV (Device component use); USES (Uses)
(**cathode** active material; org. electrolyte **batteries** with **cathodes** comprising **lithium** manganese oxide and **carbon nanotube**)

L21 ANSWER 19 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 1997:247511 HCAPLUS
DOCUMENT NUMBER: 126:227671
TITLE: Anodes for nonaqueous secondary batteries and

batteries using them
INVENTOR(S): Nitsuta, Yoshiaki; Shimamura, Harunari; Okamura, Kazuhiro
PATENT ASSIGNEE(S): Matsushita Electric Ind Co Ltd, Japan
SOURCE: Jpn. Kokai Tokkyo Koho, 5 pp.
CODEN: JKXXAF
DOCUMENT TYPE: Patent
LANGUAGE: Japanese
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 09045312	A2	19970214	JP 1995-194563	199507 31

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PRIORITY APPLN. INFO.: JP 1995-194563 199507 31

<--

AB Claimed **anodes** comprise **carbon nanotube** compds. having spacing of d(002) 0.34 nm and opening at the both ends, which contain 10-100 ppm ≥1 of **Li**, Na, K, Mg, and Ca in hollow area. **Batteries** comprise the **anodes** and **Li**-intercalating **cathodes** are also claimed. The **batteries** prevent **Li** dendrite growth and have high capacity.

IT **7439-93-2, Lithium**, uses
RL: MOA (Modifier or additive use); USES (Uses)
(**anodes** contg. doped **carbon nanotube** for nonaq. **batteries**)

RN 7439-93-2 HCAPLUS
CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

IC ICM H01M004-02
ICS C01B031-02; H01M004-58; H01M010-40
CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
ST **anode carbon nanotube lithium battery**; alkali metal **carbon nanotube anode**; alk earth **carbon nanotube anode**
IT Secondary **batteries**
(**lithium**; **anodes** contg. doped **carbon nanotube** for nonaq. **batteries**)
IT **7439-93-2, Lithium**, uses 7439-95-4, Magnesium, uses 7440-09-7, Potassium, uses 7440-23-5, Sodium, uses 7440-70-2, Calcium, uses
RL: MOA (Modifier or additive use); USES (Uses)
(**anodes** contg. doped **carbon nanotube** for nonaq. **batteries**)

L21 ANSWER 20 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 1995:453440 HCAPLUS
DOCUMENT NUMBER: 122:192537
TITLE: Battery electrode matrix and batteries with nonaqueous electrolyte
INVENTOR(S): Tabuchi, Junji; Shohata, Nobuaki; Numata, Tatsuji
PATENT ASSIGNEE(S): Nippon Electric Co, Japan

SOURCE: Jpn. Kokai Tokkyo Koho, 5 pp.
CODEN: JKXXAF
DOCUMENT TYPE: Patent
LANGUAGE: Japanese
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 07014582	A2	19950117	JP 1993-175929	199306 24
			<--	
JP 2513418	B2	19960703		

PRIORITY APPLN. INFO.: JP 1993-175929 199306 24
<--

AB The matrix comprises **cathode** active materials, binder, and conducting agent of carbonaceous materials contg. **carbon nanotubes** or those contg. metal ions. **Batteries** comprising the matrix, **Li**-absorbable **anodes**, and nonaq. solvent electrolytes are also claimed. Internal resistance of the **batteries** are decreased by use of **carbon nanotubes.**

IT **7439-93-2, Lithium**, uses
RL: DEV (Device component use); USES (Uses)
(**anode; battery cathodes** contg. (metal-contg.) **carbon nanotubes** and **batteries**)

RN 7439-93-2 HCAPLUS
CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

IC ICM H01M004-62
ICS H01M004-02; H01M010-40

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)

IT **Lithium** alloy, base
RL: DEV (Device component use); USES (Uses)
(**battery cathodes** contg. (metal-contg.) **carbon nanotubes** and **batteries**)

IT **7439-93-2, Lithium**, uses
RL: DEV (Device component use); USES (Uses)
(**anode; battery cathodes** contg. (metal-contg.) **carbon nanotubes** and **batteries**)

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L1 1 SEA FILE=REGISTRY ABB=ON PLU=ON CARBON/CN
L2 1 SEA FILE=REGISTRY ABB=ON PLU=ON GRAPHITE/CN
L3 1 SEA FILE=REGISTRY ABB=ON PLU=ON LITHIUM/CN
L4 4455789 SEA FILE=HCAPLUS ABB=ON PLU=ON L1 OR L2 OR CARBON OR

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L6          35853 SEA FILE=HCAPLUS ABB=ON  PLU=ON  CNT OR CARBON NANOTUBE#
                  OR NANOTUBE#
L7           9345 SEA FILE=HCAPLUS ABB=ON  PLU=ON  MWNT# OR SWNT# OR
                  MULTI? WALL? (2A) NANOTUBE# OR MULTIWALL? (2A) NANOTUBE#
                  OR SINGLE? (2A) WALL? NANOTUBE# OR SINGLEWALL? (2A)
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                  (L) L5 (L) CATHODE#
L11           146 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L4 (L) L6 (L) BATTER?
                  (L) L5 (L) ANODE#
L12            27 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L10 AND L11
L13            14 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L10 AND L7
L14            37 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L11 AND L7
L15            27 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L12 AND ELECTROCHEM?/SC,
                  SX
L16            19 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L15 AND (1840-2003)/PRY,
                  PY,AY
L17            43 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L13 OR L14
L18            41 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L17 AND ELECTROCHEM?/SC,
                  SX
L19            21 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L18 AND (1840-2003)/PRY,
                  PY,AY
L20             1 SEA FILE=HCAPLUS ABB=ON  PLU=ON  2004:1019587/AN
L21            20 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L20 OR L16
L22            15 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L19 NOT L21


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=> d l22 1-15 ibib abs hitstr hitind

L22  ANSWER 1 OF 15  HCAPLUS  COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER:         2003:677093  HCAPLUS
DOCUMENT NUMBER:          140:7031
TITLE:                    Electron diffraction and X-ray studies of new
                          LiC10 and LiC8 structures in chemically
                          lithiated single wall carbon nanotubes
AUTHOR(S):                Gabrisch, Heike; Yazami, Rachid; Fultz, Brent
CORPORATE SOURCE:         Division of Engineering and Applied Science,
                          California Institute of Technology, Pasadena,
                          CA, 91125, USA
SOURCE:                   Proceedings - Electrochemical Society (
                          2003), 2001-21(Batteries and
                          Supercapacitors), 351-359
                          CODEN: PESODO; ISSN: 0161-6374
PUBLISHER:                Electrochemical Society
DOCUMENT TYPE:            Journal
LANGUAGE:                 English
AB   Single-walled C nanotubes were reacted with molten Li at 220°
     for 2 wk.  X-ray and TEM studies indicate that a significant
     fraction of the initial SWNTs transformed from cylindrical
     C nanotubes to flat nanostrips having intercalated Li between them.
     The Li atoms form a superlattice commensurate with that of
     graphite-like nanostrips with a0√7 + a0√3
     in-plane distribution.  This new structure corresponds to a LiC10
     compn.  A minor phase of LiC8 was also detected by TEM-diffraction.
IT   7439-93-2, Lithium, reactions
     RL: RCT (Reactant); RACT (Reactant or reagent)
        (LiC10 and LiC8 structures formed by chem. lithiation of
```

single-walled **carbon nanotube anode** material for **lithium batteries**)
RN 7439-93-2 HCAPLUS
CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

IT **7440-44-0, Carbon**, uses
RL: RCT (Reactant); TEM (Technical or engineered material use); RACT (Reactant or reagent); USES (Uses)
(**nanotubes**; LiC10 and LiC8 structures formed by chem. lithiation of single-walled **carbon nanotube anode** material for **lithium batteries**)
RN 7440-44-0 HCAPLUS
CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 78
ST **lithium** carbide **anode** lithiation **carbon nanotube** unzipping **lithium battery**
IT **Battery anodes**
(LiC10 and LiC8 structures formed by chem. lithiation of single-walled **carbon nanotube anode** material for **lithium batteries**)
IT **Nanotubes**
(**carbon**; LiC10 and LiC8 structures formed by chem. lithiation of single-walled **carbon nanotube anode** material for **lithium batteries**)
IT 84863-15-0 143436-38-8
RL: FMU (Formation, unclassified); PRP (Properties); FORM (Formation, nonpreparative)
(LiC10 and LiC8 structures formed by chem. lithiation of single-walled **carbon nanotube anode** material for **lithium batteries**)
IT **7439-93-2, Lithium**, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(LiC10 and LiC8 structures formed by chem. lithiation of single-walled **carbon nanotube anode** material for **lithium batteries**)
IT **7440-44-0, Carbon**, uses
RL: RCT (Reactant); TEM (Technical or engineered material use); RACT (Reactant or reagent); USES (Uses)
(**nanotubes**; LiC10 and LiC8 structures formed by chem. lithiation of single-walled **carbon nanotube anode** material for **lithium batteries**)
REFERENCE COUNT: 11 THERE ARE 11 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 2 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2003:617876 HCAPLUS
DOCUMENT NUMBER: 139:352595
TITLE: Investigation of Lithium Storage in Bamboo-like CNTs by HRTEM
AUTHOR(S): Wang, Qing; Li, Hong; Chen, Liquan; Huang, Xuejie; Zhong, Dingyong; Wang, Engé
CORPORATE SOURCE: Laboratory for Solid State Ionics, Chinese Academy of Sciences, Beijing, 100080, Peop. Rep. China

SOURCE: Journal of the Electrochemical Society (2003), 150(9), A1281-A1286 Aug 5, 2003
CODEN: JESOAN; ISSN: 0013-4651
PUBLISHER: Electrochemical Society
DOCUMENT TYPE: Journal
LANGUAGE: English

AB **Multiwalled C nanotubes (CNTs**) with bamboo-like cavity structures (BCNTs) was studied by high resoln. transmission electron microscope (HRTEM) as **anode** materials for **Li**-ion **batteries.** It has a reversible **Li**-storage capacity of 460 mA-h/g and a stable cyclic capability. The HRTEM images of BCNTs at a **Li** -inserted state as well as for a **Li**-extn. state were obtained. An amorphous passivation film with a thickness of 5-7 nm was obsd. on the outside of the BCNTs after discharge to 0 V. The fringe spacings of the graphene wall expanded and the **graphite** structure in some areas was partly damaged due to the insertion of **Li.** **Li** nanocrystallites with various lattice structures are presumably inside the tube. When the samples were charged to 3.5 V, the stripes of **Li** nanocrystallites disappeared and the graphene wall partly recovered to the pristine state. This is the 1st direct observation of **Li** storage within the cavities of **C** for a deep **Li**-insertion state.

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
Section cross-reference(s): **72**

ST **lithium** storage bamboo **carbon nanotube** **anode battery**

IT **Battery anodes**
(HRTEM of **lithium** storage in bamboo-like **carbon** **nanotubes**)

REFERENCE COUNT: 34 THERE ARE 34 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 3 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2003:437381 HCAPLUS
DOCUMENT NUMBER: 139:263163
3/25/03
TITLE: Preparation and characterization of carbon nanotubes for energy storage
AUTHOR(S): Wang, G. X.; Ahn, Jung-ho; Yao, Jane; Lindsay, Matthew; Liu, H. K.; Dou, S. X.
CORPORATE SOURCE: Institute for Superconducting and Electronic Materials, Battery Technology Research Program, University of Wollongong, Wollongong, 2522, Australia
SOURCE: Journal of Power Sources (**2003**), 119-121, 16-23
CODEN: JPSODZ; ISSN: 0378-7753
PUBLISHER: Elsevier Science B.V.
DOCUMENT TYPE: Journal
LANGUAGE: English

AB **Multiwall C nanotubes (MWNTs)** were synthesized using CVD. The morphol. and microstructure of **MWNTs** were obsd. via HRTEM. The **multiwall** C **nanotubes** are entangled in bundles with a diam. of several tens of nanometers. Electrochem. properties of **MWNTs** were examd. via a variety of electrochem. tests. The **MWNT** electrode demonstrated a reversible Li storage capacity of 340 mA-h/g with good cyclability at moderate c.d. The kinetic properties of Li insertion in **MWNTs** electrodes were characterized via a.c. impedance measurements. The Li diffusion coeff. decreases with an increase in Li-ion concn. in the **MWNTs** electrodes.

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy

Technology)
Section cross-reference(s): 72
ST **multiwall carbon nanotube anode lithium** ion **battery**
IT Nanotubes
(carbon; prepn. and characterization of **multiwall carbon nanotube** electrodes for lithium-ion batteries)
IT Secondary batteries
(lithium; prepn. and characterization of **multiwall carbon nanotube** electrodes for lithium-ion batteries)
IT **Battery anodes**
(prepn. and characterization of **multiwall carbon nanotube** electrodes for **lithium** -ion **batteries**)
IT 7439-93-2, Lithium, uses
RL: CPS (Chemical process); DEV (Device component use); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)
(prepn. and characterization of **multiwall** carbon **nanotube** electrodes for lithium-ion batteries)
REFERENCE COUNT: 20 THERE ARE 20 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 4 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2002:501636 HCAPLUS
DOCUMENT NUMBER: 137:172340
TITLE: **Carbon nanotube anodes** for **lithium** ion **batteries**
AUTHOR(S): Raffaelle, Ryne P.; Gennett, Thomas; Maranchi, Jeff; Kumta, Prashant; Hepp, Aloysius F.; Heben, Michael J.; Dillon, Anne C.; Jones, Kim C.
CORPORATE SOURCE: NanoPower Research Labs, Rochester Institute of Technology, Rochester, NY, 14623, USA
SOURCE: Materials Research Society Symposium Proceedings (**2002**), 706(Making Functional Materials with Nanotubes), 343-349
CODEN: MRSPDH; ISSN: 0272-9172
PUBLISHER: Materials Research Society
DOCUMENT TYPE: Journal
LANGUAGE: English
AB Highly purified single-wall **carbon nanotubes** were investigated for use as an **anode** material for thin-film **lithium**-ion **batteries.** The high purity **nanotubes** were obtained by chem. refinement of soot generated by pulsed laser ablation. The purity of the **nanotubes** was detd. by thermogravimetric anal., SEM, and transmission electron microscopy. The sp. surface area and **lithium** capacity of the single-wall **carbon nanotubes** was compared to that of other conventional **anode** materials, i.e., **carbon** black, **graphite**, and **multi-walled carbon nanotubes.** The Brunauer-Emmett-Teller technique based on nitrogen adsorption was used to measure the sp. surface area of the various **anode** materials. The single-wall **carbon nanotubes** exhibited a sp. surface area on the order of 915 m2/g, much higher than the other carbonaceous materials. Cyclic voltammetric behavior and the **lithium**-ion capacity of the materials were measured using a std. 3-electrode electrochem. cell. The cyclic voltammetry showed evidence of staging that was similar to other carbonaceous materials. The electrochem. discharge capacity of the purified single-wall **carbon nanotubes** was in excess of 1300 mA-h/g after 30 charge/discharge cycles when tested using a c.d. of 20 μA/cm2.

IT **7440-44-0, Carbon**, uses
RL: CPS (Chemical process); DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(**nanotubes**; investigation of **carbon nanotubes** as **anode** for **lithium**-ion **batteries**)
RN 7440-44-0 HCAPLUS
CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
ST **carbon nanotube anode lithium** ion **battery**
IT **Nanotubes**
(**carbon**; investigation of **carbon nanotubes** as **anode** for **lithium**-ion **batteries**)
IT **Battery anodes**
(investigation of **carbon nanotubes** as **anode** for **lithium**-ion **batteries**)
IT **7440-44-0, Carbon**, uses
RL: CPS (Chemical process); DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(**nanotubes**; investigation of **carbon nanotubes** as **anode** for **lithium**-ion **batteries**)
REFERENCE COUNT: 13 THERE ARE 13 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 5 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2002:288161 HCAPLUS
DOCUMENT NUMBER: 137:111601
TITLE: Nanotubes as anode material for lithium-ion batteries
AUTHOR(S): Loutfy, Raouf O.; Hossain, S.; Moravsky, A.; Saleh, M.
CORPORATE SOURCE: MER Corporation, Tucson, AZ, USA
SOURCE: Perspectives of Fullerene Nanotechnology (**2002**), 341-355. Editor(s): Osawa, Eiji. Kluwer Academic Publishers: Dordrecht, Neth. CODEN: 69CLLN; ISBN: 0-7923-7174-7
DOCUMENT TYPE: Conference
LANGUAGE: English
AB **Carbon nanotubes** including arc **multi-walled nanotubes** (arc-**MWNT**), arc- and laser-produced **single-walled nanotubes** (**SWNT**), and catalytically grown **multi-walled nanotubes** (vapor grown, VG **MWNT**, and chem. vapor deposited, CVD **MWNT**) were investigated as **anode** materials for **lithium** ion intercalation and de-intercalation. As-produced arc-**MWNT** deliver capacity in the range of 190-210 mA-h/g and an irreversible capacity in the range of 90-140 mA-h/g. The reversible capacity improved to 310-340 mA-h/g with purifn. and opening of the ends of the tubes. **SWNT** delivered relatively high reversible capacity of >600 mA-h/g but they were assocd. with very high irreversible capacity (.apprx.200%) that makes these materials impractical to use as an **anode** material for **lithium batteries**.
Vapor-grown nanofibers exhibited poor reversible capacity and also

very high irreversible capacity. On the other hand, CVD **MWNT** delivered >400 mA-h/g reversible capacity with relatively low irreversible capacity (<25%).

IT **7440-44-0, Carbon**, uses
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
(**nanotubes; carbon nanotubes** as **anode** material for **lithium**-ion **batteries**)

RN 7440-44-0 HCAPLUS
CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)

ST **carbon nanotube anode lithium** ion **battery**

IT **Battery anodes**
(**carbon nanotubes** as **anode** material for **lithium**-ion **batteries**)

IT **Nanotubes**
(**carbon; carbon nanotubes** as **anode** material for **lithium**-ion **batteries**)

IT **7440-44-0, Carbon**, uses
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
(**nanotubes; carbon nanotubes** as **anode** material for **lithium**-ion **batteries**)

REFERENCE COUNT: 5 THERE ARE 5 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 6 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2002:86130 HCAPLUS
DOCUMENT NUMBER: 136:372163
TITLE: Electrochemical lithium insertion in template-synthesized highly-aligned **multi-wall** carbon **nanotubes**
AUTHOR(S): Mukhopadhyay, I.; Inahara, J.; Hoshino, N.; Okino, F.; Kawasaki, S.; Touhara, H.; Kyotani, T.; Tomita, A.
CORPORATE SOURCE: Department of Materials Chemistry, Faculty of Textile Science and Technology, Shinshu University, Ueda, 386-8567, Japan
SOURCE: Proceedings - Electrochemical Society (**2001**), 2001-11(Fullerenes--Volume 11: Fullerenes for the New Millennium), 15-18
CODEN: PESODO; ISSN: 0161-6374
PUBLISHER: Electrochemical Society
DOCUMENT TYPE: Journal
LANGUAGE: English

AB **Anode** performance of template-synthesized **multi-wall carbon nanotubes (MWNTs)** in **Li batteries** was investigated. The pristine sample showed irreversible and reversible capacities of 1340 and 300 mAh/g in the initial cycle. Heat treatment at 1000° increased the BET surface area with an increase in the irreversible and reversible capacities. However, with an increase in the heat-treatment temp. to 3000°, the irreversible and reversible capacities decreased to 663 and 200 mAh/g but the coulomb

efficiency increased by 10% in the initial cycle. High temp. treatment at 3000° induced better crystallinity and good alignment of the graphene layers along the **c**-axis that increases the coulomb efficiency.

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
Section cross-reference(s): **72**

ST **carbon nanotube lithium battery anode**

IT **Battery anodes**
Nanotubes
(electrochem. **lithium** insertion in template-synthesized **multi-wall carbon nanotubes**)

IT Secondary batteries
(lithium; electrochem. lithium insertion in template-synthesized **multi-wall** carbon **nanotubes**)

REFERENCE COUNT: 7 THERE ARE 7 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 7 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2002:52347 HCAPLUS
DOCUMENT NUMBER: 136:328038
TITLE: Electrochemical Li insertion in B-doped **multiwall** carbon **nanotubes**
AUTHOR(S): Mukhopadhyay, I.; Hoshino, N.; Kawasaki, S.; Okino, F.; Hsu, W. K.; Touhara, H.
CORPORATE SOURCE: Department of Materials Chemistry, Faculty of Textile Science and Technology, Shinshu University, Ueda, 386-8567, Japan
SOURCE: Journal of the Electrochemical Society (**2002**), 149(1), A39-A44
CODEN: JESOAN; ISSN: 0013-4651
PUBLISHER: Electrochemical Society
DOCUMENT TYPE: Journal
LANGUAGE: English

AB Electrochem. Li insertion into boron-doped **multiwall** carbon **nanotubes** (B-**MWNTs**) was investigated in a nonaq. medium. Transmission electron microscopy observations showed that the walls of the tubes consisted of highly aligned ca. 35-45 graphene layers with good 3D ordering feature. Raman studies revealed that boron doping in **multiwall** carbon **nanotubes** (**MWNTs**) destroyed the local hexagonal symmetry. X-ray photoelectron spectra of B-**MWNTs** further supported the results of Raman spectra and confirmed the presence of BC3 nanodomains. N2 adsorption measurements indicated that the Brunauer-Emmett-Teller (BET) surface areas of undoped and doped nanotubes were 10 and 12 cm2/g, resp., with almost similar mesopore vols. Galvanostatic discharge-charge measurements revealed that the reversible capacity was 156 mAh/g for undoped and 180 mAh/g for B-doped nanotubes in the first cycle with almost equal coulomb efficiencies of 55-58%. The coulomb efficiency increased to more than 90% after the second cycle. Cyclic voltammetry (CV) showed that highly reversible intercalation/deintercalation of Li occurred with some undesirable redn. processes in the initial discharge process. The cycle lives of both undoped and doped samples were quite satisfactory. Slow-scan CV confirmed that the intercalation of lithium in these nanotubes occurred through staging transition, usually obsd. in Li graphite intercalation compds.

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)

ST **battery anode carbon nanotube lithium** intercalation

IT Nanotubes
(carbon; electrochem. Li insertion in B-doped **multiwall**

carbon **nanotubes**)
IT **Battery anodes**
Intercalation
(electrochem. **Li** insertion in B-doped **multiwall carbon nanotubes**)
IT 7439-93-2, Lithium, processes
RL: PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process)
(electrochem. Li insertion in B-doped **multiwall** carbon **nanotubes**)
REFERENCE COUNT: 22 THERE ARE 22 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 8 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2001:697561 HCAPLUS
DOCUMENT NUMBER: 136:56311
TITLE: Fluorotubes as Cathodes in Lithium Electrochemical Cells
AUTHOR(S): Peng, Haiqing; Gu, Zhenning; Yang, Jiping; Zimmerman, J. L.; Willis, P. A.; Bronikowski, M. J.; Smalley, R. E.; Hauge, R. H.; Margrave, J. L.
CORPORATE SOURCE: Department of Chemistry and the Center for Nanoscale Science and Technology, Rice University, Houston, TX, 77005, USA
SOURCE: Nano Letters (**2001**), 1(11), 625-629
CODEN: NALEFD; ISSN: 1530-6984
PUBLISHER: American Chemical Society
DOCUMENT TYPE: Journal
LANGUAGE: English
AB Fluorotubes (C2F) were prepd. by fluorinating **SWNTs** (single wall carbon nanotubes) with F2/HF at 250 °C for 12 h and were consequently used as cathode material in a lithium electrochem. cell. The Raman and FTIR spectra of the fluorotubes were investigated before and after the cell was discharged. The discharging performance of the fluorotube/lithium electrochem. cell was studied and compared with that of a carbon monofluoride (CFx)/lithium cell. Thermodn. calcns. using the ΔHf° of fluorotubes and carbon monofluoride indicated that the potential of a fluorotube/lithium electrochem. cell, where the fluorotubes were made by the fluorination of armchair (10,10) **SWNTs**, should be 0.4 V higher than that of a carbon monofluoride/lithium cell. The exptl. results support the theor. calcns. The relation between **SWNT** diam. and cell potential was also investigated.
CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 57, **72**
ST **lithium battery cathode** fluorinated **carbon nanotube**
IT **Nanotubes**
RL: DEV (Device component use); USES (Uses)
(**carbon**, fluorinated; fluorotubes as **cathodes** in **lithium batteries**)
REFERENCE COUNT: 13 THERE ARE 13 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 9 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2001:498220 HCAPLUS
DOCUMENT NUMBER: 135:291163
TITLE: Effects of synthesis condition of graphitic carbon nanotube on anodic property of Li-ion rechargeable battery
AUTHOR(S): Ishihara, T.; Kawahara, A.; Nishiguchi, H.;

Yoshio, M.; Takita, Y.
CORPORATE SOURCE: Faculty of Engineering, Department of Applied Chemistry, Oita University, Oita, 870-1192, Japan
SOURCE: Journal of Power Sources (2001), 97-98, 129-132
CODEN: JPSODZ; ISSN: 0378-7753
PUBLISHER: Elsevier Science S.A.
DOCUMENT TYPE: Journal
LANGUAGE: English
AB Effects prepn. condition of **multi-wall** carbon **nanotube** on Li intercalation were investigated in this study. Both Li intercalation and reversible capacities increased with increasing contact time of CH4 on Ni catalyst when the **multi-wall** carbon **nanotube** was prepd. Raman spectroscopy suggested that the content of graphitic carbon tube increased with increasing the contact time of CH4 upon synthesis. Therefore, in case of tubular carbon, graphitic carbon also exhibited a larger capacity for Li intercalation comparing with that of amorphous one. Intercalation and reversible capacity for Li insertion at first cycle were attained to a value of 430 and 320 mAh/g, resp., on the carbon nanotube obtained at the contact time higher than 100 g-cat h/mol.
CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
ST **lithium** rechargeable **battery anode** **carbon nanotube**
IT **Battery anodes**
Intercalation
Nanotubes
(effects of synthesis condition of graphitic **carbon** **nanotube** on anodic property of **Li**-ion rechargeable **battery**)
REFERENCE COUNT: 9 THERE ARE 9 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 10 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2001:57665 HCAPLUS
DOCUMENT NUMBER: 134:103217
TITLE: Electrochemical lithium intercalation into **multiwall** carbon **nanotubes**: a micro-Raman study
AUTHOR(S): Maurin, G.; Bousquet, Ch.; Henn, F.; Bernier, P.; Almairac, R.; Simon, B.
CORPORATE SOURCE: LPMC, UMR 5617 CNRS, CC 003., University of Montpellier II Sciences et Techniques du Languedoc, Montpellier, F-34095, Fr.
SOURCE: Solid State Ionics (2000), 136-137, 1295-1299
CODEN: SSIOD3; ISSN: 0167-2738
PUBLISHER: Elsevier Science B.V.
DOCUMENT TYPE: Journal
LANGUAGE: English
AB The electrochem. intercalation of lithium into carbon electrodes contg. **multiwall** carbon **nanotubes** produced by elec. arc technique was carried out in button cells in different electrolytes. An exfoliation of graphene layers was obsd. with the electrolyte LiPF6 (1M) dissolved in ethylene carbonate (EC), propylene carbonate (PC) and di-Me carbonate (DMC) (1:1:3 by vol.). Raman spectra were recorded to elucidate the lithium intercalation mechanisms of **multiwall nanotubes.** The spectral changes of the Raman E2g band showed that the lithium was intercalated between graphene layers of carbon nanotubes without the formation of n-staged phases with n higher than 2 in contrast to the intercalation into graphite which proceeds via the formation of

staged graphite intercalation compds.
CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 49
ST lithium electrochem intercalation **multiwalled** carbon **nanotube**
IT **Nanotubes**
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(carbon fibers, **multiwalled**; micro-Raman study of electrochem. lithium intercalation into **multiwall** carbon **nanotubes**)
IT **Nanotubes**
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(carbon, **multiwalled**; micro-Raman study of electrochem. lithium intercalation into **multiwall** carbon **nanotubes**)
IT Intercalation
(electrochem.; micro-Raman study of electrochem. lithium intercalation into **multiwall** carbon **nanotubes**)
IT Secondary batteries
(lithium; micro-Raman study of electrochem. lithium intercalation into **multiwall** carbon **nanotubes**)
IT **Battery anodes**
Exfoliation
(micro-Raman study of electrochem. **lithium** intercalation into **multiwall carbon nanotubes**)
IT Carbon fibers, uses
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(**nanotube**, **multiwalled**; micro-Raman study of electrochem. lithium intercalation into **multiwall** carbon **nanotubes**)
IT 96-49-1, Ethylene carbonate 108-32-7, Propylene carbonate 616-38-6, Dimethyl carbonate 21324-40-3, Lithium hexafluorophosphate
RL: NUU (Other use, unclassified); TEM (Technical or engineered material use); USES (Uses)
(micro-Raman study of electrochem. lithium intercalation into **multiwall** carbon **nanotubes**)
IT 7439-93-2, Lithium, processes
RL: PEP (Physical, engineering or chemical process); PROC (Process)
(micro-Raman study of electrochem. lithium intercalation into **multiwall** carbon **nanotubes**)
IT 7440-44-0, Carbon, uses 7782-42-5, Graphite, uses
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(micro-Raman study of electrochem. lithium intercalation into **multiwall** carbon **nanotubes**)
REFERENCE COUNT: 11 THERE ARE 11 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 11 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2000:575465 HCAPLUS
DOCUMENT NUMBER: 133:166157
TITLE: First-Principles Study of Li-Intercalated Carbon Nanotube Ropes
AUTHOR(S): Zhao, Jijun; Buldum, Alper; Han, Jie; Ping Lu, Jian
CORPORATE SOURCE: Department of Physics and Astronomy, University of North Carolina at Chapel Hill, Chapel Hill, NC, 27599, USA

SOURCE: Physical Review Letters (**2000**), 85(8), 1706-1709
CODEN: PRLTAO; ISSN: 0031-9007
PUBLISHER: American Physical Society
DOCUMENT TYPE: Journal
LANGUAGE: English

AB We studied **Li**-intercalated **carbon nanotube** ropes by first-principles methods. Results show charge transfer between **Li** and **C** and small structural deformation due to intercalation. Both the interior of the **nanotube** and the interstitial space are susceptible for intercalation. The **Li** intercalation potential of a **single-walled nanotube** rope is comparable to that of **graphite** and almost independent of the **Li** d. up to around LiC2, as obsd. in recent expts. This d. is significantly higher than that of **Li** -intercalated **graphite**, making the nanorope a promising candidate for the **anode** material in **battery** applications.

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)

ST **battery anode lithium** intercalated **carbon nanotube**

IT **Battery anodes**
Electronic structure
(first-principles study of **lithium**-intercalated **carbon nanotube** ropes)

REFERENCE COUNT: 24 THERE ARE 24 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 12 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2000:398814 HCAPLUS
DOCUMENT NUMBER: 133:46090
TITLE: Electrochemical performance of carbon nanotube materials in lithium ion batteries
AUTHOR(S): Liu, Ping; Hornyak, G. Louis; Dillon, Anne C.; Gennett, Thomas; Heben, Michael J.; Turner, John A.
CORPORATE SOURCE: National Renewable Energy Laboratory, Golden, CO, 80401, USA
SOURCE: Proceedings - Electrochemical Society (**2000**), 99-25, 31-39
CODEN: PESODO; ISSN: 0161-6374
PUBLISHER: Electrochemical Society
DOCUMENT TYPE: Journal
LANGUAGE: English

AB Single-walled (**SWNT**), multi-walled (**MWNT**) and template-synthesized (TSNT) **carbon nanotube** materials have been tested as **anodes** in **lithium batteries**. **MWNTs**, made by an arc-discharge process, showed reversible capacity of 200 mAh/g and flat profiles similar to those of graphitic **carbons**. **SWNTs**, prepd. by a laser vaporization method, exhibited **lithium** intercalation behavior that depended on the prepn. conditions. In particular, a high degree of **lithium** ordering was obsd. in **SWNTs** prepd. in hydrogen/argon mixts. TSNTs, formed by chem. vapor deposition (CVD) of propylene gas at 800° **C** within porous alumina templates membranes, consisted of nanocryst. and disordered **graphite**. We found that increasing the diam. of TSNTs from 30 to 90 nm and annealing at 1200.degree.**C** improved the **lithium** storage capacity.

CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 49, 57, 72

ST **lithium battery carbon nanotube** electrochem performance; **battery anode carbon nanotube** electrochem performance
IT **Battery anodes**
Electric discharge
Laser ablation
(electrochem. performance of **carbon nanotubes** in **lithium** ion **batteries**)
REFERENCE COUNT: 7 THERE ARE 7 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 13 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2000:36485 HCAPLUS
DOCUMENT NUMBER: 132:154259
TITLE: Potential use of **carbon nanotubes** as **anode** materials for **lithium batteries**
AUTHOR(S): Touhara, Hidekazu
CORPORATE SOURCE: Dep. Mater. Chem., Fac. Textile Sci. Technol., Shinshu Univ., 3-15-1 Tokida, Ueda, 386-8567, Japan
SOURCE: Oyo Butsuri (**2000**), 69(1), 33-37
CODEN: OYBSA9; ISSN: 0369-8009
PUBLISHER: Oyo Butsuri Gakkai
DOCUMENT TYPE: Journal; General Review
LANGUAGE: Japanese
AB A review with 22 refs. Both single-wall and **multiwall carbon nanotubes** are amphoteric, and form donor and acceptor compds. The nanosize space and texture of **carbon nanotubes** allow electrochem. **lithium** insertion and extn. in an aprotic medium. The chem. and electrochem. of **carbon nanotubes** are still in their infancy, however, their properties have been suggesting the potential for use as high-capacity **anode** materials for rechargeable **lithium batteries.**
IT **7440-44-0, Carbon**, uses
RL: DEV (Device component use); USES (Uses)
(**nanotubes**; potential use of **carbon nanotubes** as **anode** materials for **lithium batteries**)
RN 7440-44-0 HCAPLUS
CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

CC 52-0 (**Electrochemical**, Radiational, and Thermal Energy Technology)
ST review **carbon nanotube anode lithium battery**
IT **Nanotubes**
RL: DEV (Device component use); USES (Uses)
(**carbon**; potential use of **carbon nanotubes** as **anode** materials for **lithium batteries**)
IT **Battery anodes**
(potential use of **carbon nanotubes** as **anode** materials for **lithium batteries**)
IT **7440-44-0, Carbon**, uses
RL: DEV (Device component use); USES (Uses)
(**nanotubes**; potential use of **carbon nanotubes** as **anode** materials for

lithium batteries)

L22 ANSWER 14 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 1999:813044 HCAPLUS
DOCUMENT NUMBER: 132:110479
TITLE: Determination of the chemical diffusion coefficient of lithium in **multiwall** carbon **nanotubes**
AUTHOR(S): Maurin, G.; Bousquet, Ch.; Henn, F.; Simon, B.
CORPORATE SOURCE: LPMC, UMR 5617 CNRS, CC 003, LPMC, UMR 5617 CNRS, CC 003, University of Montpellier II Sciences et Techniques du Languedoc, Montpellier, F-34095, Fr.
SOURCE: Ionics (**1999**), 5(1 & 2), 156-160
CODEN: IONIFA; ISSN: 0947-7047
PUBLISHER: Institute for Ionics
DOCUMENT TYPE: Journal
LANGUAGE: English
AB Electrochem. interaction of lithium into **multiwall** carbon **nanotubes** produced by the arc-elec. technique has been carried out in button cells to est. the solid state diffusion coeffs. of lithium. The results are interpreted providing that the lithium species enter the nanotubes perpendicularly to their walls and thus give rise to a necklace structure as obsd. by TEM. Finally, the results are compared with the data obtained for different kinds of carbon: carbon fiber, petroleum coke and graphite.
CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 65, **72**
ST **carbon nanotube lithium** diffusion coeff; **battery anode carbon nanotube lithium** diffusion coeff
IT Nanotubes
RL: DEV (Device component use); PRP (Properties); USES (Uses)
(carbon; detn. of chem. diffusion coeff. of lithium in **multiwall** carbon **nanotubes**)
IT **Battery anodes**
Diffusion
(detn. of chem. diffusion coeff. of **lithium** in **multiwall carbon nanotubes**)
IT 7440-44-0, Carbon, uses
RL: DEV (Device component use); PRP (Properties); USES (Uses)
(detn. of chem. diffusion coeff. of lithium in **multiwall** carbon **nanotubes**)
IT 7439-93-2, Lithium, processes
RL: PEP (Physical, engineering or chemical process); PROC (Process)
(detn. of chem. diffusion coeff. of lithium in **multiwall** carbon **nanotubes**)
REFERENCE COUNT: 17 THERE ARE 17 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 15 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 1999:465094 HCAPLUS
DOCUMENT NUMBER: 131:288742
TITLE: Electrochemical insertion of lithium in catalytic **multi-walled** carbon **nanotubes**
AUTHOR(S): Leroux, F.; Metenier, K.; Gautier, S.; Frackowiak, E.; Bonnamy, S.; Beguin, F.
CORPORATE SOURCE: CRMD, CNRS-Universite, Orleans, 45071, Fr.
SOURCE: Journal of Power Sources (**1999**), 81-82, 317-322
CODEN: JPSODZ; ISSN: 0378-7753
PUBLISHER: Elsevier Science S.A.

DOCUMENT TYPE: Journal
LANGUAGE: English
AB Electrochem. lithium insertion was studied into purified and heat-treated catalytic **multi-walled** carbon **nanotubes.** It appears that the irreversible capacity for the **MWNTs** is relatively large, but decreasing with annealing temp. This clearly shows that the intrinsic entanglement and the microtexture of the nanotubes must be responsible for this drawback of any potential application as an anode. The crucial role of the charge cut-off on the 'traditional' intercalation was underlined and the reversible capacity was assigned to particular Li sites by high resoln. NMR spectroscopy.
CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
Section cross-reference(s): **72**
ST electrochem **lithium** insertion catalytic **carbon nanotube**; annealing **multi walled carbon nanotube** insertion; **battery anode carbon nanotube lithium** insertion
IT Nanotubes
RL: DEV (Device component use); USES (Uses)
(carbon; electrochem. insertion of lithium in catalytic **multi-walled** carbon **nanotubes**)
IT Annealing
Battery anodes
Oxidation
(electrochem. insertion of **lithium** in catalytic **multi-walled carbon nanotubes**
)
IT Intercalation
(electrochem.; electrochem. insertion of lithium in catalytic **multi-walled** carbon **nanotubes**)
IT Secondary batteries
(lithium; electrochem. insertion of lithium in catalytic **multi-walled** carbon **nanotubes**)
REFERENCE COUNT: 14 THERE ARE 14 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

=> d his full

(FILE 'HOME' ENTERED AT 11:45:22 ON 23 OCT 2006)

FILE 'REGISTRY' ENTERED AT 11:52:21 ON 23 OCT 2006
L1 1 SEA ABB=ON PLU=ON CARBON/CN
L2 1 SEA ABB=ON PLU=ON GRAPHITE/CN
L3 1 SEA ABB=ON PLU=ON LITHIUM/CN

FILE 'HCAPLUS' ENTERED AT 11:53:19 ON 23 OCT 2006
L4 4455789 SEA ABB=ON PLU=ON L1 OR L2 OR CARBON OR GRAPHITE OR C
L5 397713 SEA ABB=ON PLU=ON L3 OR LITHIUM OR LI
L6 35853 SEA ABB=ON PLU=ON CNT OR CARBON NANOTUBE# OR NANOTUBE#
L7 9345 SEA ABB=ON PLU=ON MWNT# OR SWNT# OR MULTI? WALL? (2A) NANOTUBE# OR MULTIWALL? (2A) NANOTUBE# OR SINGLE? (2A) WALL? NANOTUBE# OR SINGLEWALL? (2A) NANOTUBE#
L8 486 SEA ABB=ON PLU=ON L4 (L) L6 (L) BATTER?
L9 295 SEA ABB=ON PLU=ON L4 (L) L6 (L) BATTER? (L) L5
L10 62 SEA ABB=ON PLU=ON L4 (L) L6 (L) BATTER? (L) L5 (L) CATHODE#
L11 146 SEA ABB=ON PLU=ON L4 (L) L6 (L) BATTER? (L) L5 (L) ANODE#
L12 27 SEA ABB=ON PLU=ON L10 AND L11
L13 14 SEA ABB=ON PLU=ON L10 AND L7
L14 37 SEA ABB=ON PLU=ON L11 AND L7
L15 27 SEA ABB=ON PLU=ON L12 AND ELECTROCHEM?/SC,SX

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L16          19 SEA ABB=ON  PLU=ON  L15 AND (1840-2003)/PRY,PY,AY
L17          43 SEA ABB=ON  PLU=ON  L13 OR L14
L18          41 SEA ABB=ON  PLU=ON  L17 AND ELECTROCHEM?/SC,SX
L19          21 SEA ABB=ON  PLU=ON  L18 AND (1840-2003)/PRY,PY,AY
L20           1 SEA ABB=ON  PLU=ON  2004:1019587/AN
L21          20 SEA ABB=ON  PLU=ON  L20 OR L16
L22          15 SEA ABB=ON  PLU=ON  L19 NOT L21
L23         582 SEA ABB=ON  PLU=ON  NANOTUBE# (2A) CATHODE#
L24         180 SEA ABB=ON  PLU=ON  NANOTUBE# (2A) ANODE#
L25          22 SEA ABB=ON  PLU=ON  L23 AND L24
L26           6 SEA ABB=ON  PLU=ON  L25 AND ELECTROCHEM?/SC,SX
L27           1 SEA ABB=ON  PLU=ON  L26 AND (1840-2003)/PRY,PY,AY
L28         476 SEA ABB=ON  PLU=ON  NANOTUBE# (L) CATHODE# AND NANOTUBE#
                (L) ANODE#
L29          37 SEA ABB=ON  PLU=ON  L28 AND (LI OR LITHIUM)
L30          34 SEA ABB=ON  PLU=ON  L28 AND (LI OR LITHIUM) AND BATTER?
L31          23 SEA ABB=ON  PLU=ON  L30 AND (1840-2003)/PRY,PY,AY
L32          23 SEA ABB=ON  PLU=ON  L31 OR L27
L33           4 SEA ABB=ON  PLU=ON  L32 NOT (L21 OR L22)


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=> d l33 que stat
L1            1 SEA FILE=REGISTRY ABB=ON  PLU=ON  CARBON/CN
L2            1 SEA FILE=REGISTRY ABB=ON  PLU=ON  GRAPHITE/CN
L3            1 SEA FILE=REGISTRY ABB=ON  PLU=ON  LITHIUM/CN
L4      4455789 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L1 OR L2 OR CARBON OR
                GRAPHITE OR C
L5       397713 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L3 OR LITHIUM OR LI
L6        35853 SEA FILE=HCAPLUS ABB=ON  PLU=ON  CNT OR CARBON NANOTUBE#
                OR NANOTUBE#
L7         9345 SEA FILE=HCAPLUS ABB=ON  PLU=ON  MWNT# OR SWNT# OR
                MULTI? WALL? (2A) NANOTUBE# OR MULTIWALL? (2A) NANOTUBE#
                OR SINGLE? (2A) WALL? NANOTUBE# OR SINGLEWALL? (2A)
                NANOTUBE#
L10          62 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L4 (L) L6 (L) BATTER?
                (L) L5 (L) CATHODE#
L11         146 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L4 (L) L6 (L) BATTER?
                (L) L5 (L) ANODE#
L12          27 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L10 AND L11
L13          14 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L10 AND L7
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L15          27 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L12 AND ELECTROCHEM?/SC,
                SX
L16          19 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L15 AND (1840-2003)/PRY,
                PY,AY
L17          43 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L13 OR L14
L18          41 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L17 AND ELECTROCHEM?/SC,
                SX
L19          21 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L18 AND (1840-2003)/PRY,
                PY,AY
L20           1 SEA FILE=HCAPLUS ABB=ON  PLU=ON  2004:1019587/AN
L21          20 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L20 OR L16
L22          15 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L19 NOT L21
L23         582 SEA FILE=HCAPLUS ABB=ON  PLU=ON  NANOTUBE# (2A) CATHODE#

L24         180 SEA FILE=HCAPLUS ABB=ON  PLU=ON  NANOTUBE# (2A) ANODE#
L25          22 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L23 AND L24
L26           6 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L25 AND ELECTROCHEM?/SC,
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                SX
L27           1 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L26 AND (1840-2003)/PRY,
                PY,AY
L28         476 SEA FILE=HCAPLUS ABB=ON  PLU=ON  NANOTUBE# (L) CATHODE#
                AND NANOTUBE# (L) ANODE#
L30          34 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L28 AND (LI OR LITHIUM)
                AND BATTER?
L31          23 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L30 AND (1840-2003)/PRY,
                PY,AY
L32          23 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L31 OR L27
L33           4 SEA FILE=HCAPLUS ABB=ON  PLU=ON  L32 NOT (L21 OR L22)


=> file hcaplus
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=> d l33 1-4 ibib abs hitstr hitind

L33  ANSWER 1 OF 4  HCAPLUS  COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER:         2004:994553  HCAPLUS
DOCUMENT NUMBER:          142:201507
TITLE:                    Micro battery based on carbon
                          nanotubes
INVENTOR(S):              Ahn, Gye Hyeok; Lee, Young Hee; Yoo, Jae Eun
PATENT ASSIGNEE(S):       Iljin Nanotech Inc., S. Korea
SOURCE:                   Repub. Korean Kongkae Taeho Kongbo, No pp. given
                          CODEN: KRXXA7
DOCUMENT TYPE:            Patent
LANGUAGE:                 Korean
FAMILY ACC. NUM. COUNT:   1
PATENT INFORMATION:

     PATENT NO.           KIND   DATE        APPLICATION NO.        DATE
     ---------------      ----   --------    --------------------
     --------
     KR 2003043177         A     20030602    KR 2001-74217
                                                                   200111
                                                                   27
                                                 <--
PRIORITY APPLN. INFO.:                       KR 2001-74217
                                                                   200111
                                                                   27
                                                 <--
AB   This micro battery is used as a miniaturized power supply.
     The thin-film cathode comprises C nanotubes,
     there is an anode of a thin film opposite the
     cathode.  A solid electrolyte thin film is placed between
     the anode and the cathode.  The cathode
     includes a material which is made of the solid electrolyte filled
     between the C nanotubes.  The solid electrolyte is
     selected from Li3PO4, LiPO3, LiBO2, LiO2, B2O3, V2O5, P2O5 and SiO2.
IC   ICM  H01G009-04
CC   52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST   carbon nanotube cathode electrolyte micro
     battery
IT   Battery cathodes
        (carbon nanotube cathode material for micro
        batteries)
IT   Nanotubes
        (carbon; micro battery based on carbon nanotubes)
IT   Primary batteries
     Secondary batteries
```

(micro **battery** based on carbon nanotubes)
IT 1303-86-2, Boron oxide (B2O3), uses 1314-56-3, Phosphorus oxide (P2O5), uses 1314-62-1, Vanadium oxide (V2O5), uses 7631-86-9, Silica, uses 10377-52-3, **Lithium** phosphate (Li3PO4) 12136-56-0, **Lithium** superoxide 13453-69-5, **Lithium** metaborate (LiBO2) 13762-75-9, **Lithium** phosphate (LiPO3)
RL: DEV (Device component use); USES (Uses)
(carbon **nanotube cathode** material for micro **batteries** with)
IT 7440-44-0, Carbon, uses
RL: DEV (Device component use); USES (Uses)
(nanotubes; micro **battery** based on carbon nanotubes)

L33 ANSWER 2 OF 4 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2004:820315 HCAPLUS
DOCUMENT NUMBER: 141:341628
TITLE: Semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active cathode materials
INVENTOR(S): Baba, Mamoru
PATENT ASSIGNEE(S): Japan Science and Technology Agency, Japan
SOURCE: Jpn. Kokai Tokkyo Koho, 12 pp.
CODEN: JKXXAF
DOCUMENT TYPE: Patent
LANGUAGE: Japanese
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2004281593	A2	20041007	JP 2003-69100	200303 14
			<--	
PRIORITY APPLN. INFO.:			JP 2003-69100	200303 14
			<--	

AB The title semiconductor devices have a solid thin-film micro-sized secondary **battery** built in monolithic formation patterned by photolithog. on a porous **cathode** active material which is reformed from a portion of Si crystal semiconductor substrate or from a carbon **nanotube** film from a portion of SiC crystal semiconductor substrate.
IC ICM H01L021-822
ICS H01L021-3063; H01L027-04; H01M004-02; H01M004-38; H01M004-58; H01M010-40; C01B033-02
CC 76-3 (Electric Phenomena)
Section cross-reference(s): 52
ST carbon **nanotube cathode** silicon carbide reformation semiconductor substrate **battery**; silicon semiconductor device substrate monolith reformation porous **cathode battery**
IT Secondary **batteries**
(built in semiconductor device; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
IT Photolithography
(patterning of porous **battery** cathode from semiconductor substrate; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)

IT **Battery** cathodes
(porous semiconductor substrate; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
IT Semiconductor devices
(semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
IT Porous materials
(silicon and silicon carbide; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
IT Semiconductor materials
(substrate, porous reformation for **battery** cathode; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
IT 12057-17-9, **Lithium** manganese oxide (LiMn2O4)
RL: PEP (Physical, engineering or chemical process); PRP (Properties); PYP (Physical process); PROC (Process)
(anode active materials; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
IT 11099-22-2
RL: DEV (Device component use); PRP (Properties); USES (Uses)
(contact interlayer; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
IT 7440-44-0P, Carbon, properties
RL: DEV (Device component use); PNU (Preparation, unclassified); PRP (Properties); PREP (Preparation); USES (Uses)
(**nanotubes**, semiconductor substrate reformed monolith porous **battery cathode**; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active **anode** materials)
IT 409-21-2, Silicon carbide, properties 7440-21-3, Silicon, properties
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PYP (Physical process); PROC (Process); USES (Uses)
(semiconductor substrate reformation for monolith porous **battery** cathode; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
IT 10377-52-3, **Lithium** phosphate (Li3PO4)
RL: DEV (Device component use); PRP (Properties); USES (Uses)
(solid electrolyte; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)

L33 ANSWER 3 OF 4 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2004:230582 HCAPLUS
DOCUMENT NUMBER: 140:360197
TITLE: Reversible hydrogen and **lithium** storage of MoS2 nanotubes
AUTHOR(S): Chen, J.; Li, S. L.; Tao, Z. L.; Zhang, L. Z.
CORPORATE SOURCE: Institute of New Energy Materials Chemistry, Nankai University, Tianjin, 300071, Peop. Rep. China
SOURCE: International Journal of Nanoscience (**2002**), 1(3 & 4), 295-302
CODEN: IJNNAJ; ISSN: 0219-581X
PUBLISHER: World Scientific Publishing Co. Pte. Ltd.
DOCUMENT TYPE: Journal

LANGUAGE: English
AB Inorg. fullerene-like MoS2 nanotubes, synthesized by a gas-solid reaction, were used as electrode materials for H and **Li** storage in aq. and nonaq. electrolytes, resp. Results for reversible H redn./oxidn. and **Li** insertion were obtained.
CC 52-2 (**Electrochemical**, Radiational, and Thermal Energy Technology)
Section cross-reference(s): **72**
ST molybdenum sulfide **nanotube anode** **cathode** hydrogen **lithium** storage **battery**
IT **Battery anodes**
Battery cathodes
Nanotubes
(reversible hydrogen and **lithium** storage in MoS2 **nanotubes** for **battery** electrodes)
IT 1317-33-5, Molybdenum sulfide (MoS2), uses
RL: DEV (Device component use); USES (Uses)
(nanotubes; reversible hydrogen and **lithium** storage in MoS2 nanotubes for **battery** electrodes)
IT 1333-74-0, Hydrogen, processes 7439-93-2, **Lithium**, processes
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PROC (Process)
(reversible hydrogen and **lithium** storage in MoS2 nanotubes for **battery** electrodes)
REFERENCE COUNT: 23 THERE ARE 23 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L33 ANSWER 4 OF 4 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2001:3468 HCAPLUS
DOCUMENT NUMBER: 134:118312
TITLE: Template synthesis of nano-structured electrode materials and its electrochemical performance
AUTHOR(S): Zhao, Jian; Gao, Quan-yong; Yang, Yong; Lin, Zu-geng
CORPORATE SOURCE: State Key Lab for Phys. Chem. of Solid Surface and Dept. of Chem., Xiamen Univ., Xiamen, 361005, Peop. Rep. China
SOURCE: Dianhuaxue (**2000**), 6(4), 393-398
CODEN: DIANFX; ISSN: 1006-3471
PUBLISHER: Dianhuaxue Bianjibu
DOCUMENT TYPE: Journal
LANGUAGE: English
AB In this letter, various nano-structured materials such as spinel LiMn2O4 nanotubes/nanowires and carbon nanotubes have been prepd. by using porous alumina template. The prepd. template and materials have been characterized by AFM and TEM techniques. It is shown that size of the nanotubes can be conveniently controlled by using template method. Some preliminary results of cyclic voltammetry about nanostructured LiMn2O4 are also reported.
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 49
IT **Battery anodes**
Battery cathodes
Decomposition
Nanotubes
Sol-gel processing
(template synthesis of **nanotube** electrode material and its electrochem. performance)
IT 638-38-0, Manganese acetate 7790-69-4, **Lithium** nitrate
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(template synthesis of nanotube electrode material and its electrochem. performance)
IT 7440-44-0P, Carbon, uses 12057-17-9P, **Lithium** manganese

oxide LiMn2O4
RL: SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(template synthesis of nanotube electrode material and its electrochem. performance)
REFERENCE COUNT: 11 THERE ARE 11 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

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